FORM PTO-1390 (REV 10-94)	U S DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	ATTORNEY'S DOCKET NUMBER
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371		7510.197USWO
		U S APPLICATION NO. (If known, see 37 CFR R-1 5) Unknown 10/019922

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/FI00/00586	June 28, 2000	June 28, 1999

TITLE OF INVENTION

PROCEDURE AND SYSTEM FOR PERFORMING MOTION ESTIMATION

APPLICANT(S) FOR DO/EO/US

Seppo VALLI

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. [X] This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. [ ] This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. [X] This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(l).
4. [ ] A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.

5. [X] A copy of the International Application as filed (35 U.S.C. 371(c)(2))
    a. [X] is transmitted herewith (required only if not transmitted by the International Bureau).
    b. [X] has been transmitted by the International Bureau.
    c. [ ] is not required, as the application was filed in the United States Receiving Office (RO/US)
6. [ ] A translation of the International Application into English (35 U.S.C. 371(c)(2)).

7. [X] Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
    a. [ ] are transmitted herewith (required only if not transmitted by the International Bureau).
    b. [ ] have been transmitted by the International Bureau.
    c. [ ] have not been made; however, the time limit for making such amendments has NOT expired.
    d. [X] have not been made and will not be made.

8. [ ] A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).

9. [X] An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).

10. [ ] A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern document(s) or information included:
11. [ ] An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. [ ] An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.

13. [X] A FIRST preliminary amendment.
    [ ] A SECOND of SUBSEQUENT preliminary amendment.

14. [ ] A substitute specification.

15. [ ] A change of power of attorney and/or address letter.

16. [X] Other items or information: Petition for Revival; Courtesy Copy of International Application; 1 Sheet of Formal Drawings; Form PCT/ISA/210; International Search Report; PCT/IPER/409

U.S. APPLICATION NO (If known, see 37 C F R 1 5)	INTERNATIONAL APPLICATION NO	ATTORNEY'S DOCKET NUMBER
7510.197USWO 10/019922	PCT/FI/00586	7510.197USWO

	CALCULATIONS PTO USE ONLY

17. [X] The following fees are submitted:

BASIC NATIONAL FEE (37 CFR 1.492(a) (1)-(5)):

Search Report has been prepared by the EPO or JPO.................................$890.00

International preliminary examination fee paid to USPTO
(37 CFR 1.492(a)(1))...$710.00

No international preliminary examination fee paid to USPTO (37 CFR 1.482)
but international search fee paid to USPTO (37 CFR 1.445(a)(2)).............................$740.00

Neither international preliminary examination fee (37 CFR 1.482) nor
international search fee (37 CFR 1.445(a)(3)) paid to USPTO $1040.00

International preliminary examination fee paid to USPTO (37 CFR 1.482)
and all claims satisfied provisions of PCT Article 33(2)-(4) $100.00

ENTER APPROPRIATE BASIC FEE AMOUNT =	$ 1040.00	

Surcharge of **$130.00** for furnishing the oath or declaration later than [ ] 20 [ ] 30 months from the earliest claimed priority date (37 CFR 1.492(e)).   **$**

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	5 -20 =	0	X $18.00	$0.00	
Independent claims	2 -3 =	0	X $84.00	$0.00	
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ $260.00	$0.00	
TOTAL OF ABOVE CALCULATIONS =				$1040.00	

Reduction by 1/2 for filing by small entity, if applicable. Small entity status is claimed pursuant to 37 CFR 1.27 $0.00

SUBTOTAL =	$1040.00	

Processing fee of **$130.00** for furnishing the English translation later than [ ] 20 [ ] 30 months from the earliest claimed priority date (37 CFR 1.492(f).   + $0.00

TOTAL NATIONAL FEE =	$1040.00	

Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). $40.00 per property   + $0.00

TOTAL FEES ENCLOSED =	$1040.00	

	Amount to be: refunded	$
	charged	$

a. [X] Check(s) in the amount of $1040.00 and 1280.00 to cover the above fees is enclosed.

b. [ ] Please charge my Deposit Account No. _____ in the amount of $ _____ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. [X] The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 13-2725.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO
John J. Gresens
MERCHANT & GOULD
P.O. Box 2903
Minneapolis, MN 55402-0903

SIGNATURE: _____

NAME: John J. Gresens

REGISTRATION NUMBER: 33,112

S/N unknown

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Seppo VALLI	Docket No.:	7510.197USWO
Serial No.:	unknown	Filed:	concurrent herewith
Int'l Appln No.:	PCT/FI00/00586	Int'l Filing Date:	June 28, 2000
Title:	PROCEDURE AND SYSTEM FOR PERFORMING MOTION ESTIMATION		

CERTIFICATE UNDER 37 CFR 1.10
'Express Mail' mailing label number: EL669944346US
Date of Deposit: December 31, 2001
I hereby certify that this correspondence is being deposited with the United States Postal Service 'Express Mail Post Office To Addressee' service under 37 CFR 1.10 on the date indicated above and is addressed to the Assistant Commissioner for Patents, Washington, D.C . 20231.

By: _____
Name: Chris Stordahl

PRELIMINARY AMENDMENT

Box PCT
Assistant Commissioner for Patents
Washington, D. C. 20231

Dear Sir:

In connection with the above-identified application filed herewith, please enter the following preliminary amendments.

IN THE ABSTRACT

A new abstract page is supplied to conform to that appearing on the publication page of the WIPO application, but the new Abstract is typed on a separate page as required by U.S. practice.

IN THE SPECIFICATION

A courtesy copy of the present specification is enclosed herewith. However, the World Intellectual Property Office (WIPO) copy should be relied upon if it is already in the U.S. Patent Office.

IN THE CLAIMS

Please amend claim 4 as follows:

4. (Amended) Method as defined in claim 1, characterized in that the method further comprises the following stage:

the possible location areas of the image blocks are determined by using a shift of

one pixel, a half of a pixel or other fractional shift.

REMARKS

Applicants respectfully request that the preliminary amendment described herein be entered into the record prior to calculation of the filing fee and prior to examination and consideration of the above-identified application.

A new abstract page is supplied to conform to that appearing on the publication page of the WIPO application.

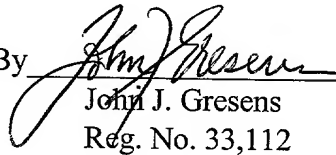Claim 4 has been amended to remove the multiple dependencies.

If a telephone conference would be helpful in resolving any issues concerning this communication, please contact Applicants' primary attorney-of record, John J. Gresens (Reg. No. 33,112), at 612.371.5265.

Respectfully submitted,

MERCHANT & GOULD P.C.
P.O. Box 2903
Minneapolis, Minnesota 55402-0903
(612) 332-5300

Dated: December 31, 2000

By _John J. Gresens_
John J. Gresens
Reg. No. 33,112

J. Gresens:hb

3

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Seppo VALLI	Docket No.:	7510.197USWO
Serial No.:	unknown	Filed:	concurrent herewith
Int'l Appln No.:	PCT/FI00/00586	Int'l Filing Date:	June 28, 2000
Title:	PROCEDURE AND SYSTEM FOR PERFORMING MOTION ESTIMATION		

VERSION WITH MARKINGS TO SHOW CHANGES MADE

4. (Amended) Method as defined in ~~any of claims 1-3~~ claim 1, ~~characterised~~ characterized in that the method further comprises the following stage:

> the possible location areas of the image blocks are determined by using a shift of one pixel, a half of a pixel or other fractional shift.

4

ABSTRACT

The present invention relates to a method and system for performing motion estimation in video image compression. In accordance with the invention, an associative memory device is used in motion estimation, and the group of the image blocks to the processed is restricted on the basis of a mean error and the best match is searched among the image blocks using the PDE method. Thanks to the invention, motion estimation may be performed via software in a regular PC environment and still more efficiently than before.

PROCEDURE AND SYSTEM FOR PERFORMING MOTION ESTIMATION

FIELD OF THE INVENTION

The invention relates to video image compression. In particular, the invention relates to a new

5   and advanced method and system of performing motion estimation in conjunction with video image compression.

PRIOR ART

10   Previously known are several methods of video image compression. For most of the methods, motion estimation is the stage demanding the most time and computing efficiency. The main principal of motion estimation is as follows. A video image consists of suc-

15   cessive frames in a time level. Each frame is divided into image blocks of certain size. Typically a block is, e.g. the size of eight by eight pixels. When coding a frame, e.g. for transmission it is being processed block by block. However, instead of transmitting

20   each block of each frame as such, an attempt is made to search from the previous frame, in the area of the image block being worked, in so called search area, a block either exactly matching with or in a certain scope close to the current block. In case this kind of

25   image block is found, just the motion vector, i.e. vector denoting the location of the found block in relation to the original one is transmitted instead of transmitting the whole block of information. The amount of the information to be sent is thereby re-

30   markably reducing.

One other method used in conjunction with video compression is vector quantization. It differs from motion estimation in that the matching tag for the block to be coded is searched from a predetermined

35   code book, instead of searching it from the previous frame. The code book is typically a group of most com-

monly appearing image blocks. The same code book is naturally used both for the encoders and decoders.

Although using motion estimation and vector quantization remarkably helps to reduce the amount of the information to be transmitted, there are, however, certain problems associated with them. Typically, especially the search phase is time-consuming. The complexity of search increases in relation to the square of the page length of the search area. Therefore, attempts have been made to develop different methods using which the search may be made fastener. The following publications disclose examples of methods with the intent to fasten motion estimation and vector quantization either by focusing on enhancing the search algorithms or using some other means: S. T. Valli, "Very Low Bitrate Coding Using Hierarchical Classified VQ and Cluster Based Segmentation of Motion Information", paper No. 7.3, VLBV94, University of Essex, UK, April 1994; H. Li, A. Lundmark, R. Forchheimer, "Image Sequence Coding at Very Low Bitrates: A Review", IEEE Transactions on Image Processing, Vol.3, No.5, September 1994; H. Abut, ed., "Vector Quantization", IEEE Press, 1990; G. Poggi, "Fast Algorithm for Full-Search VQ Encoding", Electronic Letters, Vol.29, No.123, June 1993; C.-M. Huang, Q. Bi, G. S. Stiles, R. W. Harris, "Fast Full Search Equivalent Encoding Algorithms for Image Compression Using Vector Quantization", IEEE Transactions on Image Processing, Vol.1, No.3, July 1992.

When using the present methods the search area is at maximum typically $\pm$ 15 pixels of the point of origin of the block to be coded. And even in that case the search is so complex that carrying out it via software is generally speaking not even possible, instead expensive device-based solutions have to be used, such as specific signal processing circuits. However, shifts even bigger than the $\pm$ 15 pixels men-

tioned in conjunction with the applications of low transfer rate/low image frequency are common during the motion. Thus, there is a need for more efficient methods.

5   The objective of the present invention is to disclose a method and system that would eliminate the drawbacks mentioned above. One specific objective of the invention is to disclose a method and system that makes it possible to perform motion estimation in a
10   regular PC environment and at the same time more efficiently than before.

SUMMARY OF THE INVENTION

          The method of the present invention for per-
15   forming motion estimation in video image compression comprises the following stages. On frame N, an image block that is wished to be coded is determined. On frame N-1 prior to the aforementioned frame N, a search area of motion vectors corresponding to the lo-
20   cation of the block in question is determined. The image block average values are determined in every possible location area of the image blocks included in the aforementioned search area using a shift of prede-termined size. After this, based on the image block
25   average values of the image blocks, the image blocks included in the aforementioned search area are ar-ranged in a predetermined order. Previously known is a method of performing the aforementioned arrangement by using different sorting algorithms. The disadvantage
30   associated with the algorithms in question is, how-ever, their slowness. Next, an alternative best match-ing with the image block to be coded is searched among the image blocks of the search area in question. The maximum correspondence may be determined, e.g. using a
35   minimum error, i.e. the blocks with the smallest error between them are best matching with each other.

The determining of the image block average values is used herein to mean that in a preferred case, the image block average values computed and stored already in connection with the coding of the

5   previous image blocks are retrieved from a specific image block average value memory. This is possible because the search area determined for the image block to be coded is typically partly the same as the search area corresponding to the previous coded image blocks

10 for which the determining of image block average values and storing in the memory in question has already happened. If however, motion estimation is not used in coding the previous image blocks or if the image block average value cannot be found in the aforementioned

15 memory, so the image block average value is computed and stored in the memory in question.

In the advantageous procedure presented above the image block average values of frame N-1 are computed and stored as the image blocks of frame N are

20 being coded. The image block average values may, however, be computed and stored in one go before coding the image blocks. This is, however, not preferable because motion estimation requiring computing of the image block average values is not necessarily performed

25 in coding every image block.

In accordance with the invention, the image blocks included in the search area are sorted by storing the image block average values of the image blocks in question in the memory locations of the directory

30 memory of an associative memory device in an ascending or descending order and by storing in the memory location of the output memory corresponding to each memory location of the directory memory the location data of the image blocks whose image block average value cor-

35 responds to the value stored in the memory location of the directory memory in question. As a key word of the aforementioned associative memory device, the image

block average value of the image block to be coded is used.

An associative memory device is used herein to mean a digital memory device, such as, e.g. a memory chip in which the regular address coding logic has been substituted with a specific directory memory. The directory memory consists of memory locations with, e.g. a certain character string stored in each one of them. In addition, the associative memory device includes output memory in the memory locations of which the actual data is typically stored. Each one of the memory locations of the output memory is associated with one or more memory locations of the directory memory. A certain key word, which might be, e.g. a character string, is given to the memory to serve as an input. In case a matching tag with the key word is found in some memory location of the directory memory, as output is received the content of the memory location of the output memory corresponding to the memory location of the directory memory in question. An example of an associative memory device is CAM (Content Addressable Memory, CAM). A more detailed description of an associative memory device can be found, e.g. in the publication T. Kohonen, "Self-Organization and Associative Memory", Springer-Verlag, 1984.

Further in accordance with the invention, the group of the image blocks to be processed is restricted on the basis of a mean error in accordance with the following equation:

$$Y_A = \{y_i : |\xi_x - \xi_i| \le D_{min}\}, \text{ in which}$$

Y_A represents the restricted group of the image blocks to be processed,

y_i is the candidate block i,

ξ_x is the image block average value of the image block to be coded.

ξ_i is the image block average value of the candidate block i, and

D_{min} is the error of the best candidate block per each pixel.

D_{min} may be computed, e.g. as an RMS error or
5   as a MAD error (Root-Mean-Squared, RMS; Mean-Absolute-Distortion, MAD). A more detailed description of restriction on the basis of mean error can be found, e.g. in the aforementioned publications C.-M. Huang, Q. Bi, G. S. Stiles, R. W. Harris, "Fast Full Search
10 Equivalent Encoding Algorithms for Image Compression Using Vector Quantization", IEEE Transactions on Image Processing, Vol.1, No.3, July 1992 and G. Poggi, "Fast Algorithm for Full-Search VQ Encoding", Electronic Letters, Vol.29, No.123, June 1993.

15 Furthermore in accordance with the invention, the best match is searched among the blocks included in the restricted group of images in question by using the PDE method (Partial Distance Elimination, PDE). PDE is a method known in itself, which is used, e.g.
20 in vector quantization for fastening the search. The error between the image block to be coded and the candidate block is computed normally pixel by pixel. If the error exceeds the minimum error up to that stage, the computing is stopped and the comparison is done in
25 the next candidate block.

In an embodiment of the invention, a predetermined area of regular shape around the image block to be coded is used as search area. The search area is typically, e.g. the shape of a quadrangle.

30 In an embodiment of the invention, an area is defined that is comprised of an area of one or more objects moving fast between successive image frames, and the said area is used as search area.

In an embodiment of the invention, the possi-
35 ble location areas are defined by using a shift of one pixel, a half of a pixel or some other fractional shift.

The advantage of the present invention when compared with the prior art is that it remarkably fastens motion estimation and thereby makes it possible to perform motion estimation via software in a regular

5   PC environment and still more efficiently than before. Since motion estimation may be performed via software, there is no need for expensive device-based solutions, and therefore, by the aid of the invention, motion estimation may be made more advantageous than before.

10

LIST OF FIGURES

In the following section, the invention is described by way of examples of its embodiments with reference to the attached drawing, wherein

15   Fig. 1 represents a system of the invention described in a block diagram.

DETAILED DESCRIPTION OF THE INVENTION

Fig. 1 represents the components of a system

20   of the invention. The system has been implemented, e.g. in a form of programmable components in a regular PC device. The system comprises means of determining 1 using which the image block average values are determined in the location areas of the image blocks in-

25   cluded in the search area corresponding to the location of the image block to be coded, means of sorting 2 using which the image blocks are sorted on the basis of their image block average values, and means of searching 3 using which an alternative best matching

30   with the image block to be coded is searched among the image blocks. The means of determining 1 comprise an image block average value memory (not presented), wherein the computed image block average values are stored and where they are retrieved from in case

35   needed. In practice, the image block average value

memory may be, e.g. a certain part of the memory space of a PC device.

In accordance with the invention, the system comprises a CAM memory 2 by means of which the image blocks are sorted by storing their image block average values in the memory locations of the directory memory in an ascending or descending order and by storing in the memory location of the output memory corresponding to each memory location of the directory memory the location data of the image blocks whose image block average value corresponds to the value stored in the memory location of the directory memory in question. In practice, the CAM memory 2 is advantageously a certain part of the memory space of a PC device, but it may be, e.g. a separate memory chip. Further in accordance with the invention, the system comprises means 3 for restricting the group of the image blocks to be coded on the basis of a mean error, and means 3 for searching among the image blocks included in the restricted group of images the best match by using the PDE method.

On frame N, an image block that is wished to be coded is determined. On frame N-1 prior to the aforementioned frame N, a search area of motion vectors corresponding to the location of the block in question is determined. The image block average values are determined in every possible location area of the image blocks included in the aforementioned search area using a shift of predetermined size, such as a shift of one pixel, a half of a pixel or some other fractional shift. After this, the image blocks in question are arranged in a predetermined order on the basis of their image block average values and an alternative best matching with the image block to be coded is searched among the image blocks of the search area in question. The maximum correspondence may be determined, e.g. using a minimum error, i.e. the

blocks with the smallest error between them are best matching with each other.

In practice, the determining of image block average values happens by retrieving the image block average values computed and stored already in connection with the coding of the previous image blocks from a specific image block average value memory. This is possible because the search area determined for the image block to be coded is typically partly the same as the search area corresponding to the previous coded image blocks for which the determining of image block average values and storing in the memory in question has already happened. If however, motion estimation is not used in coding the previous image blocks or if the image block average value cannot be found in the aforementioned memory for some reason or other, so the image block average value is computed and stored in the memory in question.

In the advantageous procedure presented above the image block average values of frame N-1 are computed and stored as the image blocks of frame N are being coded. The image block average values may, however, be computed and stored in one go before coding the image blocks. This is, however, not preferable because motion estimation requiring computing of the image block average values is not necessarily performed in coding every image block.

In accordance with the invention, the image blocks are sorted by storing their image block average values in the memory locations of the directory memory of the CAM memory 2 in an ascending or descending order. Further, the location data of the image blocks whose image block average value corresponds to the value stored in the memory location of the directory memory in question is stored in the memory location of the output memory corresponding to each memory location of the directory memory. As a key word of the CAM

memory 2, the image block average value of the image block to be coded is used. As search area, a predetermined area of regular shape around the image block to be coded is used. The search area is, e.g. the shape of a quadrangle. Alternatively, the search area may be an area comprised of an area formed by one or more objects moving fast between successive frames.

The invention is not restricted to the examples of its embodiments presented above, instead many variations are possible within the scope of the inventive idea defined by the claims. One such variation is the using of the present invention for the searching of matching image blocks between the images of a pair of stereo images (the left-hand and right-hand image). This procedure similar to motion estimation is described, e.g. in the publication I. Dinstein et al., "On the Compression of Stereo Images: Preliminary Results", Signal Processing 17 (1989), s. 373-382.

CLAIMS

1. A method for performing motion estimation in video image compression, which method comprises the following stages:

5   the image block to be coded is determined on frame N,

the search area corresponding to the location of the image block in question is determined on frame N-1,

10   the image block average values are determined in the location areas of the image blocks included in the search area in question by using a shift of predetermined size,

the image blocks included in the search area
15   in question are arranged in a predetermined order on the basis of the image block average values of the image blocks in question.

an alternative best matching with the image block to be coded is searched among the image blocks
20   of the search area in question, c h a r a c t e r - i s e d   in that the method further comprises the following stages:

the image blocks included in the search area are sorted by storing the image block average values
25   of the image blocks in question in the memory locations of the directory memory of an associative memory device in an ascending or descending order and by storing in the memory location of the output memory corresponding to each memory location of the directory
30   memory the location data of the image blocks whose image block average value corresponds to the value stored in the memory location of the directory memory in question,

as a key word of the aforementioned associa-
35   tive memory device, the image block average value of the image block to be coded is used,

the group of the image blocks to be processed is restricted on the basis of a mean error, and

the best match is searched among the image blocks included in the restricted group of images by
5   using the PDE method.

2. Method as defined in claim 1, c h a r - a c t e r i s e d in that the method further comprises the stage:

as search area, a predetermined area of regu-
10   lar shape around the image block to be coded is used.

3. Method as defined in claim 1, c h a r - a c t e r i s e d in that the method further comprises the following stages:

an area is defined that is comprised of an
15   area of one or more objects moving fast between suc- cessive image frames,

and the said area is used as search area.

4. Method as defined in any one of claims 1 - 3, c h a r a c t e r i s e d in that the method further
20   comprises the following stage:

the possible location areas of the image blocks are determined by using a shift of one pixel, a half of a pixel or other fractional shift.

5. A system for performing motion estimation
25   in video image compression, which system comprises:

means of determining (1) by means of which the image block average values are determined in the location areas of the image blocks included in the search area corresponding to the location of the image
30   block to be coded by using a predetermined shift on the image frame prior to the image frame including the image block to be coded in question,

means of sorting (2) by using which the image blocks are sorted on the basis of the image block av-
35   erage values of the image blocks in question, and

means of searching (3) by using which the variant best matching with the image block to be coded

is searched among the image blocks, c h a r a c t e r -
i s e d in that the system further comprises:

an associative memory device (2) by means of
which the image blocks included in the search area are
5   sorted by storing the image block average values of
the image blocks in question in the memory locations
of the directory memory of the associative memory de-
vice in question (2) in an ascending or descending or-
der and by storing in the memory location of the out-
10   put memory corresponding to each memory location of
the directory memory the location data of the image
blocks whose image block average value corresponds to
the value stored in the memory location of the direc-
tory memory in question, and the image block average
15   value of the image block to be coded is used as a key
word of the associative memory device (2).

means (3) for restricting the group of the
image blocks to be coded on the basis of a mean error,
and
20   means (3) for searching the best match among
the image blocks included in the restricted group of
images by using the PDE method.

(57) ABSTRACT

The present invention relates to a method and system for performing motion estimation in video image compression. In accordance with the invention, an associative memory device is used in motion estimation, and the group of the image blocks to be processed is restricted on the basis of a mean error and the best match is searched among the image blocks using the PDE method. Thanks to the invention, motion estimation may be performed via software in a regular PC environment and still more efficiently than before.
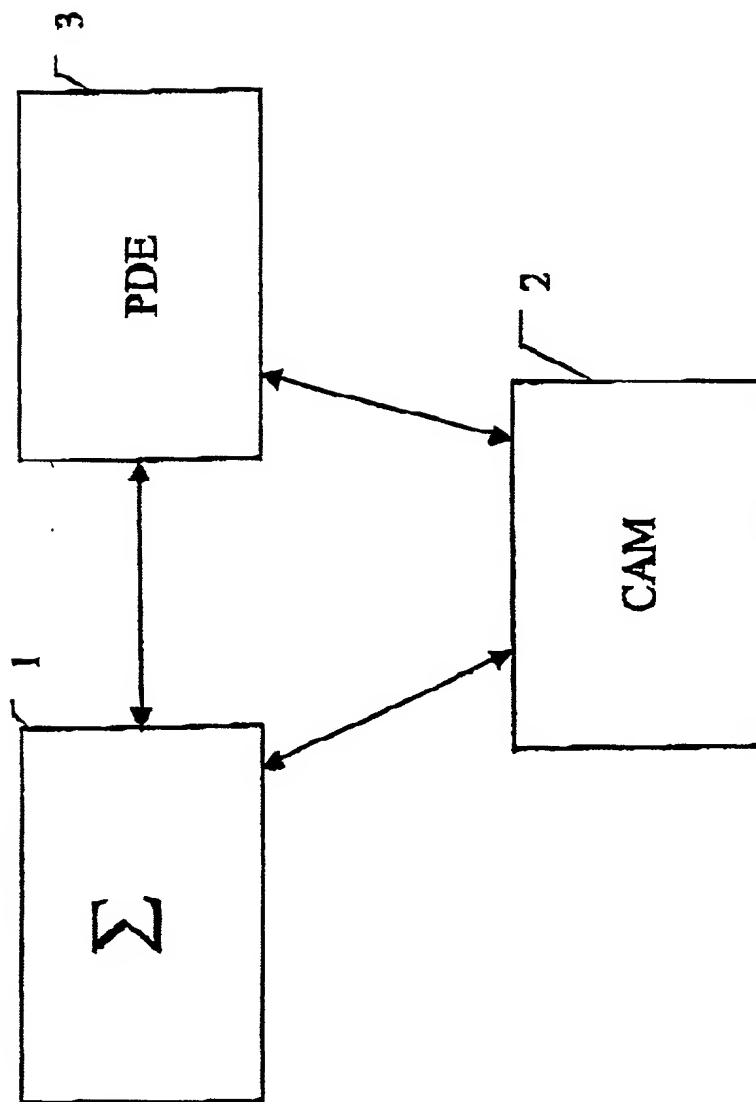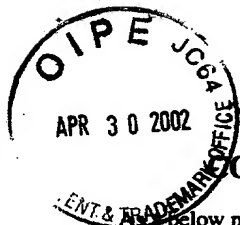
Inventor: Seppo VALLI
Docket No.: 7510.197USWO
Title: PROCEDURE AND SYSTEM FOR PERFORMING MOTION ESTIMATION
Attorney Name: John J. Gresens
Phone No.: 612.371.5265
Sheet 1 of 1

10/019922

1/1

Fig. 1

OIPE JCG4 APR 3 0 2002 ENT & TRADEMARK OFFICE

153780

MERCHANT & GOULD

United States Patent Application

COMBINED DECLARATION AND POWER OF ATTORNEY

As a below named inventor I hereby declare that: my residence, post office address and citizenship are as stated below next to my name; that

I verily believe I am the original, first and sole inventor (if only one name is listed below) or a joint inventor (if plural inventors are named below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

PROCEDURE AND SYSTEM FOR PERFORMING MOTION ESTIMATION

The specification of which

a. ☐ is attached hereto

b. ☒ was filed on _____

as application serial no. _____

and was amended on_____ (if applicable)

(in the case of PCT-filed application)

described and claimed in international no. PCT/FI00/00586 filed on 28 June 2000

and as amended on _____ (if any), which I have reviewed and for which I solicit a United States patent.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, § 1.56(a). (Reprinted on back side).

I hereby claim foreign priority benefits under Title 35, United States Code, § 119/365 of any foreign application(s) for patent of inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on the basis of which priority is claimed:

a. ☐ no such applications have been filed.

b. ☒ such applications have been filed as follows:

FOREIGN APPLICATION(S), IF ANY, CLAIMING PRIORITY UNDER 35 USC § 119			
COUNTRY	APPLICATION NUMBER	DATE OF FILING (day, month, year)	DATE OF ISSUE (day, month, year)
Finland	991469	28/06/1999	

ALL FOREIGN APPLICATIONS, IF ANY, FILED BEFORE THE PRIORITY APPLICATION(S)			
COUNTRY	APPLICATION NUMBER	DATE OF FILING (day, month, year)	DATE OF ISSUE (day, month, year)

I hereby claim the benefit under Title 35, United States Code, § 120/365 of any United States and PCT international application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, § 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application.

U.S. APPLICATION NUMBER	DATE OF FILING (day, month, year)	STATUS (patented, pending, abandoned)
APR 3 0 2002		

I hereby appoint the following attorney(s) and/or patent agent(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected herewith:

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